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| 14. ABSTRACT Information superiority is one of the primary issues for military dominance. To achieve situational awareness in a joint/combined coalition, the meaning of the exchanged information and the purpose of the information exchange must be understood identically everywhere and at all times. Recent research and development trends suggest that NATO Network Enabled Capability (NNEC) will provide a means for establishing the desired information superiority. The NNEC builds on the idea of a common information space where all participating elements and organizations have the opportunity to supply and retrieve information according to their particular roles in the operation. Information must be conveyed in a secure and trusted way. This includes the idea that the meaning of the information and the purpose of the information exchange are understood identically everywhere and at all times. This level of understanding between all elements participating in joint/combined operations requires a broad attention to the context of information and the concepts contained within the information. True understanding of the concepts within the information can be equated to understanding the semantics of the information. Several major attempts in the area of syntactic/semantic interoperability were undertaken that can be comprised into two major tracks: one track focuses on knowledge-based means that analyze and convert information by using ontologies. Relevant projects | | | | | |
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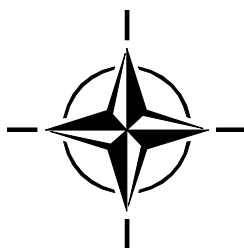
RTO MEETING PROCEEDINGS

MP-IST-101

Semantic and Domain-based Interoperability

(Interopérabilité Sémantique et Interopérabilité
basée sur un domaine)

Papers presented at the RTO Information Systems Technology Panel (IST)
Symposium held in Oslo, Norway on 7–8 November 2011.



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The Research and Technology Organisation (RTO) of NATO

RTO is the single focus in NATO for Defence Research and Technology activities. Its mission is to conduct and promote co-operative research and information exchange. The objective is to support the development and effective use of national defence research and technology and to meet the military needs of the Alliance, to maintain a technological lead, and to provide advice to NATO and national decision makers. The RTO performs its mission with the support of an extensive network of national experts. It also ensures effective co-ordination with other NATO bodies involved in R&T activities.

RTO reports both to the Military Committee of NATO and to the Conference of National Armament Directors. It comprises a Research and Technology Board (RTB) as the highest level of national representation and the Research and Technology Agency (RTA), a dedicated staff with its headquarters in Neuilly, near Paris, France. In order to facilitate contacts with the military users and other NATO activities, a small part of the RTA staff is located in NATO Headquarters in Brussels. The Brussels staff also co-ordinates RTO's co-operation with nations in Middle and Eastern Europe, to which RTO attaches particular importance especially as working together in the field of research is one of the more promising areas of co-operation.

The total spectrum of R&T activities is covered by the following 7 bodies:

- AVT Applied Vehicle Technology Panel
- HFM Human Factors and Medicine Panel
- IST Information Systems Technology Panel
- NMSG NATO Modelling and Simulation Group
- SAS System Analysis and Studies Panel
- SCI Systems Concepts and Integration Panel
- SET Sensors and Electronics Technology Panel

These bodies are made up of national representatives as well as generally recognised 'world class' scientists. They also provide a communication link to military users and other NATO bodies. RTO's scientific and technological work is carried out by Technical Teams, created for specific activities and with a specific duration. Such Technical Teams can organise workshops, symposia, field trials, lecture series and training courses. An important function of these Technical Teams is to ensure the continuity of the expert networks.

RTO builds upon earlier co-operation in defence research and technology as set-up under the Advisory Group for Aerospace Research and Development (AGARD) and the Defence Research Group (DRG). AGARD and the DRG share common roots in that they were both established at the initiative of Dr Theodore von Kármán, a leading aerospace scientist, who early on recognised the importance of scientific support for the Allied Armed Forces. RTO is capitalising on these common roots in order to provide the Alliance and the NATO nations with a strong scientific and technological basis that will guarantee a solid base for the future.

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Semantic and Domain-Based Interoperability

(RTO-MP-IST-101)

Executive Summary

INTRODUCTION

Information superiority is one of the primary issues for NATO Network Enabled Capability (NNEC). It builds on the idea of a common information space where all participating elements and organizations have the opportunity to supply and retrieve information according to their particular roles in the operation. Future, C4I systems must be capable of accessing, ‘understanding’, and utilizing the information content within this space. Information must be conveyed in a secure and trusted way. This includes the idea that the meaning of the information and the purpose of the information exchange are understood and interpreted identically everywhere and at all times. This level of understanding between all elements participating in joint/combined operations requires a broad attention to the context of information and the concepts contained within the information. True understanding of the concepts within the information can be equated to understanding the semantics of the information.

The vital need for Semantic Interoperability has been sporadically recognized and some reference projects were set up but, on one hand, there is a need for further research and, on the other hand, Semantic Interoperability still requires dissemination and must be brought to the attention of decision makers at all decision levels.

This concern and also the desire to present emerging semantic technologies and its applicability were the drivers for the RTG IST-094 on “Semantic Interoperability” to organize the Symposium.

SYMPOSIUM

During one and a half days, the Symposium offered a platform for presenting, comparing and evolving ideas and approaches on Semantic Interoperability.

This included various technologies that promise to improve interoperability within the context of military operations and support for the NATO forces as well as requirements and operational insight. One example is the ‘Domain-Based Approach’ that focuses on multiple standards co-existing and enabling overall interoperability. Another is the ‘Multilateral Interoperability Programme (MIP)’ that thus far has yielded a well-defined replication mechanism and a complex data model (Joint Command, Control & Consultation Information Exchange Data Model – JC3IEDM). Further, the ‘Framework for Semantic Interoperability’ that concentrates on the application of knowledge-based methods based on ontologies for the bridging of semantic gaps between different systems. Finally, ‘Battle Management Language (BML)’ is a man- and machine-readable artificial language which offers the ability to avoid ambiguities in human communication by restricting the syntax of sentences and determining the semantic roles of words.

Various aspects were addressed in vivid discussions and the prominent point ‘semantics’ dominated the discourse.

Interopérabilité sémantique et basée sur les domaines (RTO-MP-IST-101)

Synthèse

INTRODUCTION

La supériorité en matière d'information constitue une des questions majeures pour la Capacité en réseau de l'OTAN (NNEC). Elle s'appuie sur le concept d'un espace d'information commun où toutes les parties et organisations participantes ont la possibilité de fournir et de retirer des informations en fonction de leurs rôles particuliers dans l'opération. Les futurs systèmes C4I doivent être capables d'atteindre, de « comprendre », et d'utiliser le contenu des informations situées dans cet espace. Les informations doivent être transmises par un réseau sûr et sécurisé. Cela suppose que la signification des informations et l'objectif de l'échange d'informations sont compris et interprétés de manière identique, en tout lieu et à tout moment. Ce niveau de compréhension entre tous les membres participants engagés dans des opérations interarmées/multinationales nécessite qu'on accorde un maximum d'attention au contexte des informations et aux concepts inclus dans les informations. Une réelle compréhension de ces concepts peut être assimilée à une compréhension de la sémantique de l'information.

La nécessité vitale d'interopérabilité sémantique a été reconnue de manière sporadique et quelques projets de référence ont été créés mais d'une part, des recherches approfondies s'avèrent nécessaires et d'autre part, le concept d'interopérabilité sémantique a encore besoin d'être répandu et doit notamment être porté à la connaissance des décideurs à tous les niveaux de prise de décision.

Cette préoccupation, ainsi que la volonté de présenter les technologies sémantiques émergentes et leur applicabilité, ont servi de fil conducteur au RTG IST-094 sur « L'interopérabilité sémantique » pour organiser le symposium.

SYMPOSIUM

Durant un jour et demi, le symposium a offert un cadre d'échange pour présenter, comparer et élaborer diverses idées et approches sur l'interopérabilité sémantique.

Le programme incluait diverses technologies permettant d'améliorer l'interopérabilité dans un contexte d'opérations militaires, de soutenir les forces de l'OTAN et d'avoir une meilleure visibilité en termes de besoins et d'opérations. « L'approche basée sur les domaines » constitue un des exemples, et se concentre sur une multitude de normes coexistantes qui permettent d'obtenir une interopérabilité globale. Le « Programme d'Interopérabilité Multilatérale (PIM) », est un autre exemple qui a aujourd'hui produit un mécanisme de réplication bien défini et un modèle de données complexe (Joint Command, Control & Consultation Information Exchange Data Model – JC3IEDM). Il existe également le « Cadre d'interopérabilité sémantique » qui se concentre sur l'application de méthodes basées sur la connaissance et fondées sur l'ontologie pour combler les lacunes sémantiques entre les différents systèmes. Enfin, le « Langage de Gestion de Combat (LGC) » est un langage artificiel lisible par l'homme et l'ordinateur qui a pour avantage d'éviter les ambiguïtés présentes dans la communication humaine en réduisant la syntaxe des phrases et en déterminant les rôles sémantiques des termes.

De nombreux aspects ont été abordés au cours d'échanges animés et le thème majeur de la « sémantique » a dominé le débat.